

## Claims

We claim:

1           1. A method for controlling the expression of a  
2 gene in a living cell, comprising contacting the  
3 5'untranslated region of an RNA in the cell with a cell  
4 permeable, small molecule.

1           2. A method for controlling expression of a gene,  
2 comprising:  
3           providing an aptamer that binds specifically to a  
4 cell permeable, small molecule;  
5           incorporating the aptamer into a region of a gene,  
6 which region encodes a 5' untranslated region of an RNA;  
7           contacting the cell-permeable, small molecule with a  
8 cell that contains the gene, so that the cell-permeable,  
9 small molecule enters the cell and controls expression of  
10 the gene.

1           3. The method of claim 2, wherein the cell  
2 permeable, small molecule binds specifically to the aptamer  
3 sequence in the 5' untranslated region of RNA transcribed  
4 from the gene.

1           4. The method of claim 2, wherein the gene is an  
2 endogenous gene.

1           5. The method of claim 2, wherein the gene is a  
2 transgene.

1           6. The method of claim 2, wherein the cell is a  
2 prokaryotic cell.

1           7. The method of claim 2, wherein the cell is a  
2 eukaryotic cell.

1           8. The method of claim 7, wherein the eukaryotic  
2 cell is a mammalian cell.

1           9. The method of claim 8, wherein the mammalian  
2 cell is *in vivo*.

1           10. The method of claim 9, further comprising  
2 administering the cell permeable, small molecule to the  
3 mammal topically, parenterally, orally, vaginally, or  
4 rectally.

1           11. The method of claim 2, wherein the cell  
2 permeable, small molecule is an organic compound.

1           12. A gene comprising an aptamer sequence  
2 incorporated into a region of a gene that encodes a 5'  
3 untranslated region of an RNA.

1           13. A transgenic cell comprising an aptamer  
2 incorporated into a region of a gene that encodes a 5'  
3 untranslated region of an RNA.

1           14. The cell of claim 13, further comprising an RNA  
2 transcript containing the aptamer in the 5' untranslated  
3 region of the RNA transcript.

1           15. The cell of claim 14, further comprising a cell  
2 permeable, small molecule that binds specifically to the  
3 aptamer.

1           16. A bacterial resistance marker comprising an  
2 aptamer sequence operably linked to a bacterial expression  
3 control sequence.

1           17. A method for determining whether a gene of  
2 interest is essential for the survival or growth of a cell,  
3 comprising:  
4           structurally disrupting or deleting an endogenous  
5 gene of interest in the cell;  
6           providing an aptamer that binds specifically to a  
7 cell permeable, small molecule;  
8           incorporating the aptamer into a region of the gene  
9 of interest *in vitro*, which region encodes a 5' untranslated  
10 region of an RNA, thereby producing a controllable gene of  
11 interest;  
12           introducing the controllable gene of interest into  
13 the cell, thereby producing a test cell;  
14           contacting the cell-permeable, small molecule with  
15 the test cell, so that the cell-permeable, small molecule  
16 enters the test cell and controls expression of the  
17 controllable gene of interest.